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Mr. French

NASA

SPACE SHUTTLE MISSION STS-30
PRESS KIT

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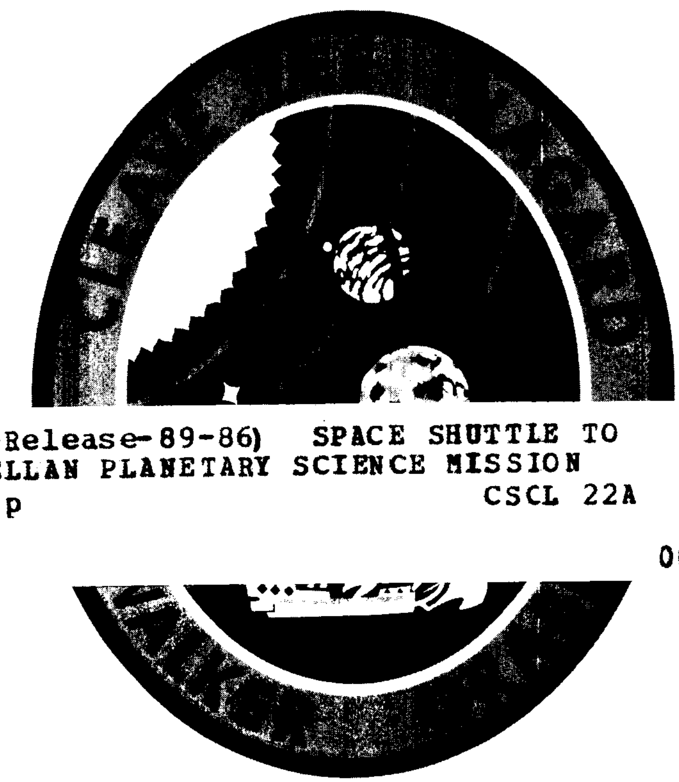

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National Aeronautics and
Space Administration

Washington, D.C. 20546
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ERATTA

Please make the following corrections in the STS-30 Press Kit (changes are underscored):

1. Page 10, 3rd paragraph, 2nd sentence, should read: "It is able to resolve surface features measuring from about 120 meters near the equator to about 300 meters near the north pole through the thick clouds that perpetually shroud the planet."

2. Page 15, 1st paragraph, 4th sentence, should read: "At its closest point to the planet, the resolution will be about 120 meters."

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CONTENTS

National Aeronautics and
Space Administration

Washington, D.C.

RELEASE: 89-46

SPACE SHUTTLE TO DEPLOY MAGELLAN PLANETARY SCIENCE MISSION

Space Shuttle mission STS-30 will deploy the Magellan Venus-exploration spacecraft into low-Earth orbit, the first U.S. planetary science mission launched since 1978 and the first planetary probe to be deployed from the Shuttle.

Following deployment, Magellan will be propelled from Earth orbit in to its Venus trajectory by an Air Force-developed, Inertial Upper Stage (IUS) booster. The spacecraft will cruise through space for some 15 months, including flying around the Sun, before reaching its Venus destination in August 1990.

Magellan's orbit insertion rockets will be fired to slow the explorer into a highly elipical orbit around planet Venus. Magellan will complete 1 orbit of Venus every 189 minutes. During its 243-day orbital mission, the spacecraft will acquire surface imaging, radiometry, altimetry and gravitational data.

Magellan will map up to 90 percent of the surface of planet Venus for the first time using a synthetic aperture radar instrument to gather high resolution, mapping data.

Commander of the 29th Space Shuttle mission is David M. Walker, captain, USN. Ronald J. Grabe, colonel, USAF, is pilot. Walker flew as the pilot aboard Discovery on mission STS-51A in November 1984, and Grabe was pilot of Atlantis on mission STS-51J in October 1985.

Mission specialists are Norman E. Thagard, M.D.; Mary L. Cleave, Ph.D.; and Mark C. Lee, major, USAF. Thagard previously flew as a mission specialist on STS-7 in June 1983 and STS-51B in April 1985. Cleave previously flew on STS-61B in November 1985. Lee is making his first Space Shuttle flight.

Liftoff of the fourth flight of orbiter Atlantis is scheduled for 2:24 p.m. EDT, April 28, from Kennedy Space Center, Fla., launch complex 39-B, into a 160-nautical-mile, 28.85-degree orbit. Nominal mission duration is 4 days, 56 minutes. Deorbit is planned on orbit 64, with landing scheduled for 3:20 p.m. EDT on May 2 at Edwards Air Force Base, Calif.

Liftoff on April 28 could occur during an 18-minute period beginning at 2:24 p.m. EDT. The launch window will grow each day by 6 to 8 minutes, reaching a maximum of 121 minutes on May 13. From May 13 until the close of the window on May 28, the launch window each day would remain at 121 minutes to protect a Transatlantic Abort Landing (TAL) abort capability. The launch window increase is dictated by the need for a daylight landing opportunity at the TAL sites.

Atlantis also will carry secondary payloads involving fluid research in general liquid chemistry and electrical storm studies. After landing, Atlantis will be towed to the NASA Ames-Dryden Flight Research Facility, Edwards, Calif., hoisted atop the Shuttle Carrier Aircraft and ferried back to the Kennedy Space Center to begin processing for its next flight.

- end -

GENERAL INFORMATION

NASA Select Television Transmission

The schedule for television transmissions from the orbiter and for the change-of-shift briefings from Johnson Space Center, Houston, will be available during the mission at Kennedy Space Center, Fla.; Marshall Space Flight Center, Huntsville, Ala.; Johnson Space Center, Houston; and NASA Headquarters, Washington, D.C. The television schedule will be updated daily to reflect changes dictated by mission operations. NASA Select television is available on Satcom F-2R, Transponder 13, located at 72 degrees west longitude.

Special Note to Broadcasters

For approximately 5 days before launch, audio interview material with the STS-30 crew will be available to broadcasters by calling 202/755-1788 between 8 a.m. to noon EDT, Monday through Friday. The material will include short sound bites, with introduction, for a total of 2 minutes. Tapes will be changed daily.

Status Reports

Status reports on the countdown, flight mission activities and landing operations will be produced by the appropriate NASA news center.

Briefings

An STS-30 mission press briefing schedule will be issued prior to launch. During the mission, flight control personnel work 8-hour shifts. Change-of-shift briefings by the off-going flight director will occur at approximately 8-hour intervals.

STS-30 QUICK LOOK

Launch Date: April 28, 1989

Launch Window: 2:24 p.m. - 2:42 p.m. EDT

Launch Site: Kennedy Space Center, Fla., Pad 39B

Orbiter: Atlantis (OV-104)

Altitude: 160 nautical miles

Inclination: 28.85 degrees

Duration: 4 days, 56 minutes

Landing Date/Time: May 2, 1989, 3:20 p.m. EDT

Primary Landing Site: Edwards Air Force Base, Calif.

Alternate Landing Sites:
Return to Launch Site - Kennedy Space Center
Transatlantic Abort Landing - Ben Guerir, Morocco
Abort Once Around - Edwards AFB

Crew:
David M. Walker, commander
Ronald J. Grabe, pilot
Norman E. Thagard, mission specialist-1
Mary L. Cleave, mission specialist-2
Mark C. Lee, mission specialist-3

Primary Payload: Magellan

Secondary Payloads:
Fluids Experiment Apparatus (FEA)
Mesoscale Lightning Experiment (MLR)

SPACE SHUTTLE LAUNCH PREPARATIONS, COUNTDOWN AND LIFTOFF

Processing activities began on Atlantis for the STS-30 mission on Dec. 14, 1988, when it was towed to Orbiter Processing Facility (OPF) bay 2 after arrival from the Ames-Dryden Flight Research Facility. Atlantis' most recent mission, STS-27, was completed with a Dec. 6, 1988, landing at Edwards Air Force Base. Post-flight deconfiguration and inspections were conducted in the processing hangar.

As planned, the three main engines were removed and taken to the main engine shop in the Vehicle Assembly Building (VAB) or the replacement of several components. During post-flight inspections, technicians discovered cracks in one of the high-pressure oxidizer turbopump bearing races on the number 3 main engine. That pump was removed and sent to Rocketdyne for analysis. It was determined that the most likely cause for the cracks was the presence of moisture inside the pump which leads to stress corrosion. The buildup process of oxidizer pumps was modified to eliminate the presence of moisture.

While in the VAB, main engine technicians replaced the turbopump that had been sent to Rocketdyne for testing. The other two pumps were replaced following rollout to the pad, where testing of all three new pumps was conducted.

Atlantis' three main engines were installed while the vehicle was in the OPF. Engine 2027 is installed in the number one position, engine 2030 is in the number two position and engine 2029 is in the number three position.

The right-hand orbital maneuvering system pod was removed in early January and transferred to the Hypergolic Maintenance Facility for repairs of a helium regulator that failed in flight. The regulator was reinstalled on Feb. 9, 1989.

Stacking of solid rocket motor (SRM) segments for flight began with the left aft booster on Mobile Launcher 1 in the Vehicle Assembly Building on Jan. 2, 1989. Booster stacking operations were completed by Feb. 19 and the external tank was mated to the two boosters on March 2.

Flight crew members were at KSC on Feb. 4 for the crew equipment interface test to become familiar with Atlantis' crew compartment and equipment associated with the mission.

The assembled Space Shuttle vehicle was rolled out of the VAB aboard its mobile launcher platform for the 4.2 mile-trip to Launch Pad 39B on March 22.

The terminal countdown demonstration test -- a dress rehearsal for STS-30 launch countdown, the flight crew and the KSC launch team -- was conducted April 6-7.

Preparations scheduled the last 2 weeks prior to launch countdown included final vehicle ordnance activities, such as power-on stray-voltage checks and resistance checks of firing circuits; loading the fuel cell storage tanks; pressurizing the hypergolic propellant tanks aboard the vehicle; final payload closeouts; and a final functional check of the range safety and SRB ignition, safe and arm devices.

The launch countdown is scheduled to pick up at the T-minus-43-hour mark, leading up to the STS-30 launch. Atlantis' fourth launch will be conducted by a joint NASA/industry team from Firing Room 1 in the Launch Control Center at Complex 39.

IUS/MAGELLAN PRELAUNCH PAYLOAD PREPARATION AT KSC

The Magellan spacecraft arrived at KSC from Denver, Colo., on Oct. 8, 1988. It made the trip aboard a specially cushioned, instrumented and environmentally controlled truck-trailer supplied by KSC. It was taken to the Spacecraft Assembly and Encapsulation Facility-2 (SAEF-2) planetary spacecraft check-out facility for integration.

The high-gain antenna was installed on Dec. 4, but removed later to facilitate other payload element integration. The forward equipment module and spacecraft upper body were mated with the liquid propulsion module on Dec. 21. Magellan's radar module was installed on Jan. 6, 1989. The storable propellants used for mid-course corrections and spacecraft control at Venus were loaded aboard on Jan. 18. The spacecraft was then mated with the Star 48 solid propellant orbit insertion motor on Feb. 3. The two solar panels were attached and tested on Feb. 5.

Together with the Deep Space Network, testing was performed to demonstrate the ability of the worldwide tracking network to communicate with Magellan and to simulate Magellan's functions at Venus. These tests also highlighted the unique characteristics that will aid flight controllers in understanding idiosyncrasies in the spacecraft's performance enroute to Venus and while in orbit around the planet.

On Feb. 15, the spacecraft was relocated from SAEF-2 to the Vertical Processing Facility for mating with its Inertial Upper Stage booster 2 days later.

On Feb. 18, a week of integrated testing began. The electrical connections between the IUS and Magellan were verified, and a test was run to affirm the ability of all the principal ground control facilities and the Deep Space Network to communicate with the payload.

The high-gain antenna was reintegrated with the spacecraft on Feb. 26 and tested for flight. A test also was run to simulate the payload's deployment from Atlantis. STS-30 astronauts Mark Lee and Mary Cleave participated in the deployment exercise.

Riding in the payload canister atop the associated transporter, the IUS/Magellan payload was transported to the launch pad on March 17. The payload was installed in the payload bay of Atlantis on March 25. An integrated electrical test with the orbiter was performed. This was followed by testing to verify that the principal ground stations could communicate with IUS/Magellan via the communications systems of the Space Shuttle.

STS-30 MISSION OBJECTIVES

The primary objective of this Space Shuttle mission is to successfully deploy the Magellan spacecraft on its way to Venus. Deployment will occur on orbit 5, 6 hours, 18 minutes into the mission. Alternate deployment opportunities are available on orbits 6 and 7, with additional backup deployment opportunities available throughout flight day 2.

Additionally, the Fluids Experiment Apparatus (FEA) and Mesoscale Lightning Experiment (MLE) middeck experiments and Air Force Maui Optical Site (AMOS), along with Detailed Test Objectives (DTO) and Detailed Secondary Objectives (DSO) will be performed during the flight.

The objectives of the Magellan mission are to obtain radar images of more than 70 percent of Venus' surface, a near-global topographic map and near-global gravity field data. The mission should help develop an understanding of the planet's geological evolution, particularly its density distribution and dynamics.

MAJOR COUNTDOWN MILESTONES

Countdown	Event
T-43 Hours	Power up the Space Shuttle vehicle.
T-30 Hours	Activate orbiter's navigation aids.
T-27 Hours (holding)	Enter the first built-in hold for 8 hours.
T-27 Hours (counting)	Begin preparations for loading fuel cell storage tanks with liquid oxygen and liquid hydrogen reactants.
T-25 Hours	Load the orbiter's fuel cell tanks with liquid oxygen.
T-22 Hours, 30 minutes	Load the orbiter's fuel cell tanks with liquid hydrogen.
T-22 Hours	Perform interface check between Houston Mission Control and the Merritt Island Launch Area (MILA) tracking station.
T-20 Hours	Activate and warm up inertial measurement units (IMUs).
T-19 Hours (holding)	Enter 8-hour built-in hold.
T-19 Hours (counting)	Resume countdown.
T-18 Hours	Activate orbiter communications system.
T-11 Hours (holding)	Start 15 hour, 4-minute built-in hold. Perform orbiter ascent switch list in the orbiter flight and mid-decks.
T-11 Hours (counting)	Retract Rotating Service Structure from vehicle to launch position.
T-9 Hours	Activate orbiter's fuel cells.
T-8 Hours	Configure Mission Control communications for launch. Start clearing blast danger area.
T-6 Hours, 30 minutes	Perform Eastern Test Range open loop command test.
T-6 Hours (holding)	Enter 1-hour built-in hold.
T-6 Hours (counting)	Start external tank chilldown and propellant loading.
T-5 Hours	Start IMU pre-flight calibration.
T-4 Hours	Perform MILA antenna alignment.
T-3 Hours (holding)	2-hour built-in hold begins. Loading the external tank is complete and is in a stable replenish mode. Ice team goes to pad for inspections. Closeout crew goes to white room to begin preparing orbiter's cabin for the flight crew's entry. Wake flight crew (launch minus 4 hours, 55 minutes).
T-3 Hours (counting)	Resume countdown.
T-2 Hours, 55 minutes	Flight crew departs O&C Building for Launch Pad 39-B (Launch minus 3 hours, 15 minutes).

T-2 Hours, 30 minutes	Crew enters orbiter vehicle (Launch minus 2 Hours, 50 minutes).
T-60 minutes	Start pre-flight alignment of IMUs.
T-20 minutes (holding)	10-minute built-in hold begins.
T-20 minutes (counting)	Configure orbiter computers for launch.
T-10 minutes	White room closeout crew cleared through the launch danger area roadblocks.
T-9 minutes (holding)	Enter 1 hour, 10-minute built-in hold. Perform status check and receive Launch Director and Mission Management Team "go."
T-9 minutes (counting)	Start ground launch sequencer.
T-7 minutes, 30 sec.	Retract orbiter access arm.
T-5 minutes	Pilot starts auxiliary power units. Arm range safety, SRB ignition systems.
T-4 minutes, 55 sec.	Start liquid oxygen drainback.
T-3 minutes, 30 sec.	Orbiter goes on internal power.
T-2 minutes, 55 sec.	Pressurize liquid oxygen tank for flight and retract gaseous oxygen vent hood.
T-1 minute, 57 sec.	Pressurize liquid hydrogen tank.
T-31 seconds	"Go" from ground computer for orbiter computers to start the automatic launch sequence.
T-28 seconds	Start solid rocket booster hydraulic power units.
T-21 seconds	Start SRB gimbal profile test.
T-6.6 seconds	Main engine start.
T-3 seconds	Main engines at 90 percent thrust.
T-0	SRB ignition, holddown-post release and liftoff.
T+7 seconds	Shuttle clears launch tower and control switches to Houston.

SPACE SHUTTLE ABORT MODES

Space Shuttle launch abort philosophy aims toward safe and intact recovery of the flight crew, orbiter and its payload. Abort modes include:

* Abort-To-Orbit (ATO) -- Partial loss of main engine thrust late enough to permit reaching a minimal 105-nautical mile orbit with orbital maneuvering system engines.

* Abort-Once-Around (AOA) -- Earlier main engine shutdown with the capability to allow one orbit around before landing at Edwards Air Force Base, Calif.; White Sands Space Harbor (Northrup Strip), N.M.; or the Shuttle Landing Facility (SLF) at Kennedy Space Center, Fla.

* Transatlantic Abort Landing (TAL) -- Loss of two main engines midway through powered flight would force a landing at Ben Guerir, Morocco; Moron, Spain; or Banjul, The Gambia.

* Return-To-Launch-Site (RTLS) -- Early shutdown of one or more engines and without enough energy to reach Ben Guerir, would result in a pitch around and thrust back toward KSC until within gliding distance of the Shuttle Landing Facility (SLF).

STS-30 contingency landing sites are Edwards AFB, White Sands, Kennedy Space Center, Ben Guerir, Moron and Banjul.

SUMMARY OF MAJOR FLIGHT ACTIVITIES

Day One

Ascent
Post-insertion checkout
Pre-deploy checkout
Magellan/Inertial Upper Stage deploy

Day Two

Magellan/IUS backup deploy opportunity
Air Force Maui Optical Site (AMOS) tests
Detailed Test Objective (DTO)/Detailed Secondary Objective (DSO)
Fluids Experiment Apparatus (FEA)
Mesoscale Lightning Experiment (MLE)

Day Three

AMOS
DTO/DSO
FEA
MLE

Day Four

AMOS
DTO/DSO
MLE
Flight control systems checkout
Cabin stowage
Landing preparations

Day Five

Deorbit preparation
Deorbit burn
Landing at Edwards Air Force Base, Calif.

STS-30 TRAJECTORY SEQUENCE OF EVENTS

EVENT	RELATIVE MET (d/h:m:s)	VELOCITY (fps)	MACH	ALTITUDE (ft)
Launch	00/00:00:00			
Begin Roll Maneuver	00/00:00:09	183	.16	774
End Roll Maneuver	00/00:00:17	365	.32	2,825
SSME Throttle Down to 65%	00/00:00:30	711	.64	9,043
Max. Dyn. Pressure (Max Q)	00/00:00:59	1,368	1.35	35,133
SSME Throttle Up to 104%	00/00:01:02	1,428	1.43	37,284
SRB Staging	00/00:02:05	4,212	3.93	153,405
Negative Return	00/00:03:58	6,915	7.39	319,008
Main Engine Cutoff (MECO)	00/00:08:31	24,286	22.70	362,243
Zero Thrust	00/00:08:38			
ET Separation	00/00:08:45			
OMS 1 Burn	00/00:10:31			
OMS 2 Burn	00/00:44:27			
Magellan/IUS Deploy (orbit 5)	00/06:18:00			
Deorbit Burn (orbit 64)	03/23:53:00			
Landing (orbit 65)	04/00:53:00			
Apogee, Perigee at MECO:	85 x 3 nm			
Apogee, Perigee post-OMS 1:	160 x 51 nm			
Apogee, Perigee post-OMS 2:	160 x 160 nm			
Apogee, Perigee post-deploy:	176 x 161 nm			

LANDING AND POST-LANDING OPERATIONS

The Kennedy Space Center is responsible for ground operations of the orbiter once it has rolled to a stop on the runway at Edwards Air Force Base. Those operations include preparing the Shuttle for the return trip to Kennedy.

After landing, the flight crew aboard Atlantis begins "safing" vehicle systems. Immediately after wheelstop, specially garbed technicians will first determine that any residual hazardous vapors are below significant levels in order for other safing operations to proceed.

A mobile white room is moved into place around the crew hatch once it is verified that there are no concentrations of toxic gases around the forward part of the vehicle. The crew is expected to leave Atlantis about 45 to 50 minutes after landing. As the crew exits, technicians enter the orbiter to complete the vehicle safing activity.

Once the initial aft safety assessment is made, access vehicles are positioned around the rear of the orbiter so that lines from the ground purge and cooling vehicles can be connected to the umbilical panels on the aft end of Atlantis.

Freon line connections are completed and coolant begins circulating through the umbilicals to aid in heat rejection and protect the orbiter's electronic equipment. Other lines provide cooled, humidified air to the payload bay and other cavities to remove any residual fumes and provide a safe environment inside Atlantis.

A tow tractor will be connected to Atlantis and the vehicle will be pulled off the runway at Edwards and positioned inside the Mate/Demate Device at the nearby Ames-Dryden Flight Research Facility. After the Shuttle has been jacked and leveled, residual fuel cell cryogenics are drained and unused pyrotechnic devices are disconnected prior to returning the orbiter to Kennedy.

The aerodynamic tail cone is installed over the three main engines, and the orbiter is bolted on top of the 747 Shuttle Carrier Aircraft for the ferry flight back to Florida. Pending completion of planned work and favorable weather conditions, the 747 would depart California about 6 days after landing for the cross-country ferry flight back to Florida. A refueling stop is necessary to complete the journey.

Once back at Kennedy, Atlantis will be towed inside the hangar-like Orbiter Processing Facility for post-flight inspections and in-flight anomaly troubleshooting. These operations are conducted in parallel with the start of routine systems reverification to prepare Atlantis for its next mission.

MAGELLAN

Mission Description

The Magellan mission will map up to 90 percent of the surface of Venus to a high degree of resolution. The spacecraft's primary science instrument is an imaging radar, called a Synthetic Aperture Radar (SAR). In addition to mapping, precise tracking of Magellan radio signals will improve our knowledge of the Venusian gravity field.

Magellan is the first planetary probe to be launched from a Space Shuttle and the first planetary spacecraft to be launched in nearly 11 years.

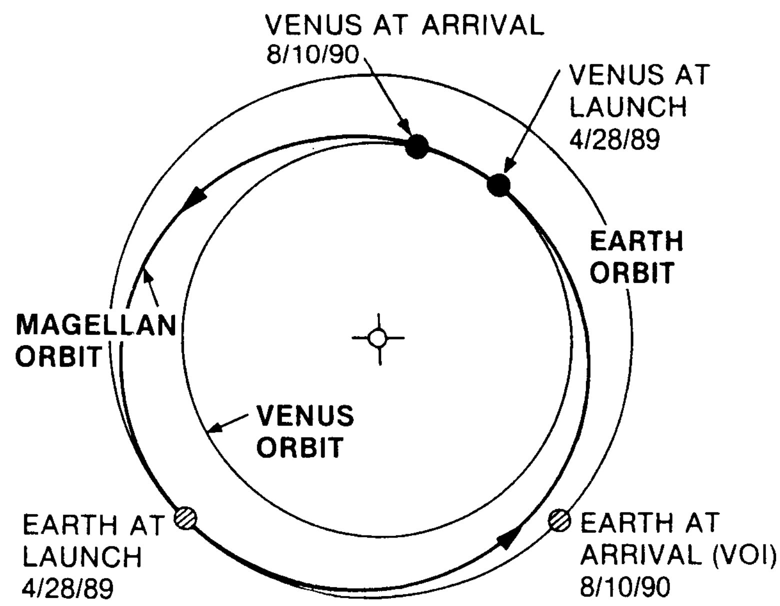
The imaging radar is capable of performing both surface imaging and altitude measurements. It is able to resolve surface features measuring from about 250 meters near the equator to about 750 meters near the north pole through the thick clouds that perpetually shroud the planet. The altimeter will measure elevations accurate to about 30 meters.

Following insertion into Venus orbit in August 1990, approximately 18 days will be spent checking out the spacecraft and its imaging radar. The prime mapping mission then will begin, lasting 243 Earth days or 1 Venus day.

A proposed extended mission would be used to map those areas missed when the Sun is between Venus and Earth and when Venus is between the spacecraft and Earth. It also would be used to determine irregularities in the planet's interior by measuring gravity.

Magellan's trajectory to Venus is called a Type IV transfer. It requires the spacecraft to go one and one-half times around the Sun before it goes into orbit around Venus. Although the Type IV transfer has advantages of lower launch energy and lower Venus approach speed, the main reason for using this trajectory is that it allows the Galileo mission to be launched by the Shuttle in October 1989, the launch time required by Magellan for the shorter and faster trajectory to Venus.

In the mapping orbit, the spacecraft will approach the planet as close as 155 miles. That is called periapsis. At its furthest point in its elliptical orbit, the spacecraft will be 4,977 miles from the planet's surface. That is apoapsis. Magellan will make one orbit every 3 hours, 9 minutes.



EARTH TO VENUS MAGELLAN TRAJECTORY

The approach to Venus is over the northern hemisphere with a mapping swath that goes from north to south. The radar mapping is done for a 37-minute period each orbit when the spacecraft is close to the planet, and when it is at apoapsis, it transmits the data back to Earth.

The mapping profile of Magellan includes two swaths of coverage done alternately, one beginning further north than the next. As the spacecraft approaches the planet, it will begin mapping the north swath at 90 degrees north latitude and continue to 54 degrees south latitude. On the next orbit, it will begin 4.7 minutes later for the south swath and begin mapping at 76 degrees north latitude and continue to 68 degrees south.

Magellan will make 1,852 mapping swaths around the planet during the primary mission. Mapping data are transmitted back to Earth at 268.8 kilobits per second. The data are received by the 70-meter tracking station network, that is, the largest radio telescopes of the Deep Space Network locations at Goldstone, Calif.; near Madrid, Spain; and at Canberra, Australia.

As each orbit continues toward apoapsis, the spacecraft plays back the data to Earth. During this time, it interrupts its playback to make star calibrations to confirm its attitude data base. Magellan looks at the positions of two stars in the sky and compares them with a star map in its computer. This fixes its attitude in relation to the planet. Then it resumes its data playback. When the second playback is completed the antenna is rotated back toward the planet for the next mapping sequence.

Magellan Spacecraft

The Magellan spacecraft was designed and constructed by Martin Marietta Astronautics Group, Denver, Colo. The height of the spacecraft is 21 feet. It is 15 ft. in diameter and weighs 7,604 pounds.

Several subsystems make up the spacecraft system. They include the structure, thermal control, power, attitude control, propulsion, command data and data storage, and telecommunications.

The structure is composed of four major sections: the high-gain antenna, forward equipment module, spacecraft bus including solar array and orbit-insertion stage.

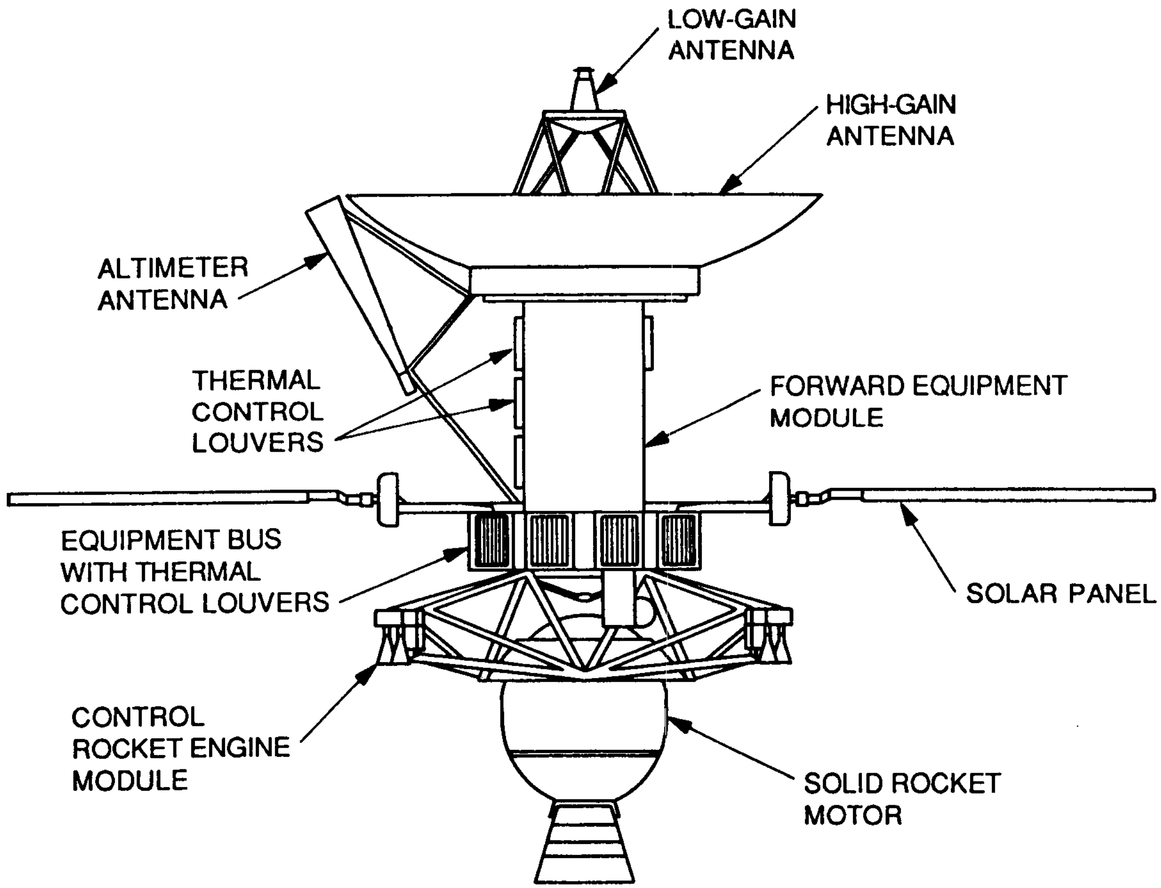
The high-gain antenna is used as the antenna for the synthetic aperture radar as well as the primary antenna for the telecommunications system to send data back to Earth. The 11.8-ft. diameter parabolic dish is made of strong, lightweight graphite epoxy sheets mounted on an aluminum honeycomb for rigidity. It is a spare from the Voyager project.

There also is a cone-shaped medium-gain antenna used for receiving commands by and sending engineering data from Magellan during the 15-month cruise from Earth. A low-gain antenna provides the ground team with an alternative means of commanding the spacecraft in case of an emergency that prevents use of normal data rates.

The altimeter antenna is mounted to one side of the high-gain antenna and is pointed vertically down at the surface of the planet during the radar data acquisitions.

The forward equipment module contains the radar electronics, the reaction wheels which control the spacecraft's attitude in space and other subsystem components.

The bus is a 10-sided structure consisting of the remainder of the subsystem components, including the solar panel array, star scanner, medium-gain antenna, rocket engine modules, command data and data storage subsystem, monopropellant tank and a nitrogen tank for propellant pressurization.



MAGELLAN SPACECRAFT

The orbit insertion stage contains a Star 48 solid rocket motor to place the spacecraft into orbit around Venus. Once in orbit, the motor casing is jettisoned.

A combination of louvers, thermal blankets, passive coatings and heat-dissipating elements are used to control the spacecraft's temperature. The normal operating temperature range for the spacecraft components is between 25 to 104 degrees Fahrenheit.

Power for the spacecraft and the experiments is provided by two solar panels with a total area of 12.6 square meters. The array is capable of producing 1,200 watts. Both direct (dc) and alternating current (ac) are provided with dc power at 28 to 35 volts and ac power at 2.4 kilohertz.

Two 30-amp hour, 26-cell nickel cadmium batteries provide power when the spacecraft is in the shadow of the planet and allow normal spacecraft operations independent of solar illumination. The batteries remain charged by using power provided by the solar arrays.

The three reaction wheels, which control the spacecraft's attitude in relation to the planet, are driven by electric motors and store momentum while they are spinning. At a point in each orbit near apoapsis, the monopropellant rocket motors are used to counteract the torque on the spacecraft as the reaction wheels are despun to eliminate the excess momentum. There is one reaction wheel for each of the spacecraft's three axes -- yaw, pitch and roll.

The Star 48 rocket used to put the spacecraft into orbit around Venus weighs 4,721 lbs., of which 4,430 lbs. are fuel. It has a thrust of 15,232 lbs.

The spacecraft also has 24 thrusters used for trajectory correction and attitude control. Eight of the thrusters have 100 lbs. of thrust each. Four have 5 lbs. of thrust and 12 have 0.2 lb. of thrust. The smallest thrusters are used for attitude control and momentum unloading of the spacecraft at apoapsis.

Radar System

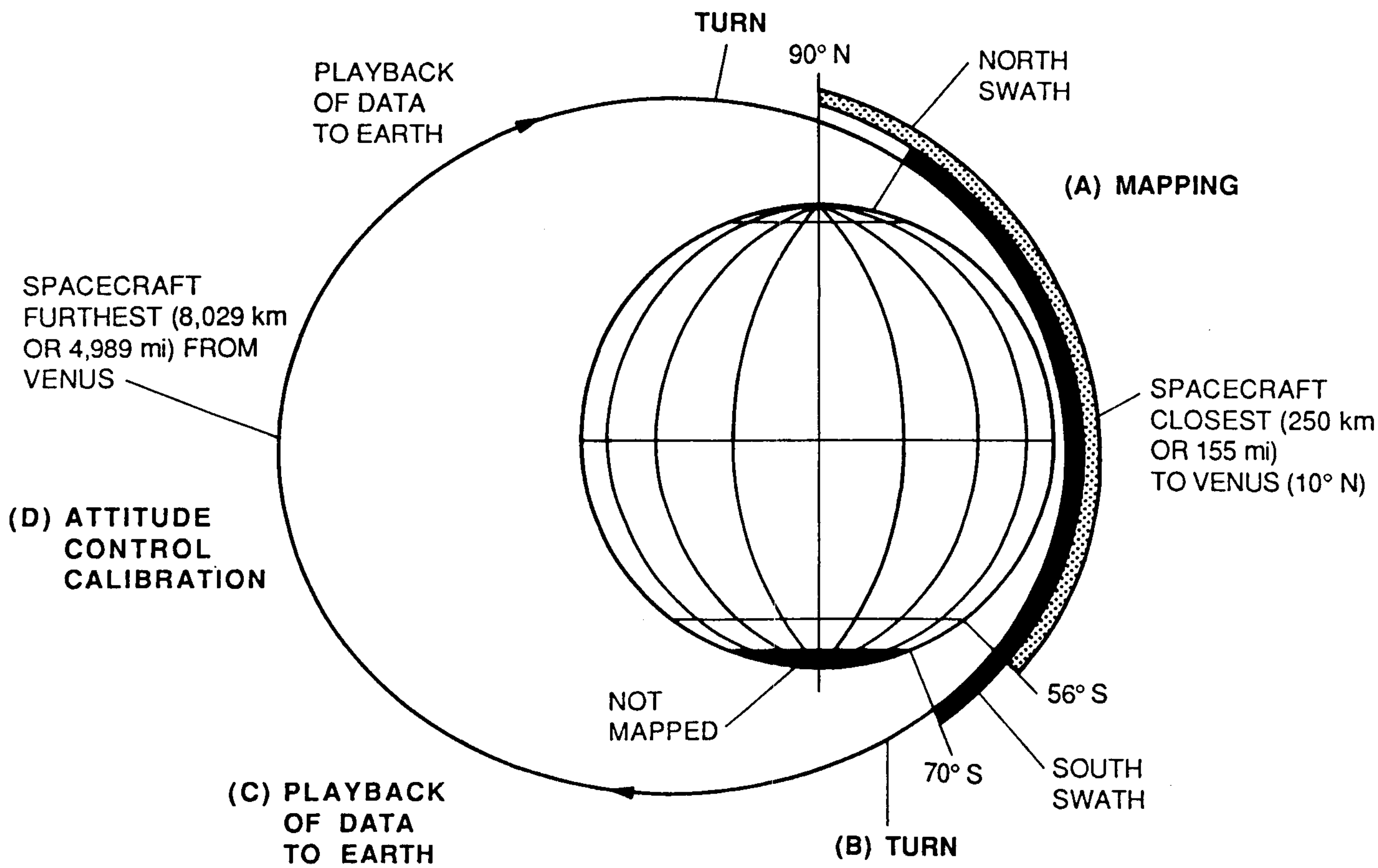
The radar system was built by the Hughes Aircraft Company, Space and Communications Group. The radar is used for Venus mapping because it can penetrate the thick clouds covering the planet. Optical photography cannot penetrate the clouds.

Real aperture radars can be used to make images, but the resolution is poor. Magellan's synthetic aperture radar (SAR) will create high-resolution images by using computer processing on Earth to simulate a large antènna on the spacecraft. The onboard radar system will operate as though it has a huge antenna, hundreds of meters long. The antenna is actually 12 ft. in diameter.

The radar system will measure the strength of the received signals (brightness), how long each signal took to make the round-trip to the target point and back (range) and changes in the signal frequency (pitch) resulting from the spacecraft's motion. That information will allow computers on Earth to develop high-resolution pictures from the data.

The SAR is sometimes called a side-looking radar because it looks at its target at an angle to the side of the flight path, while the altimetry radar looks straight down.

A digital computer on Earth forms elements of the image by taking into account the time delay, the phase (or frequency) of the radar wave and the magnitude of the radar return echo as the spacecraft moves along its path.



MAGELLAN VENUS ORBITAL OPERATIONS

While the primary function of the SAR is imaging, it also performs altimetry and radiometry. In the imaging mode, the radar views Venus with the large mapping antenna. The length of the synthetic aperture varies with the altitude and speed of Magellan as it flies by. At its closest point to the planet, the resolution will be about 250 meters. In the altimetry mode, it uses a separate antenna to look at the planet directly beneath the spacecraft and determines vertical features to a resolution of about 30 meters.

When the radar system is operated in the passive mode it operates as a radiometer and measures natural thermal emissions from the surface. That will help scientists determine the composition of surface materials.

Command and Data System (CDDS)

The brain of the spacecraft is its command and data system. It receives commands transmitted from Earth and controls the spacecraft in response to those commands. The system also controls the acquisition and storage on tape recorders of scientific data and sends that information back to Earth through the radio frequency subsystem.

The core of the system consists of computers in redundant pairs. All are fully reprogrammable and all are modified Galileo equipment.

The system, called the CDDS, stores commands for up to 3 days of radar operation during the orbit phase. There also is a provision for receiving and executing separate commands transmitted from the ground. Engineering data normally will be transmitted to Earth in real time. When a real-time link is not possible, the data will be tape recorded and played back on a high-rate link.

The imaging radar data will be stored on two multitrack digital tape recorders for later playback over the high-rate band. There is no provision for real-time transmission of the SAR data because the large antenna must be pointed at Venus during mapping.

The data storage capacity of the two digital tape recorders is about 1.8 billion bits. The recorders will be used primarily for the recording of SAR data, but low-rate engineering data can be stored during mapping or other periods when engineering data cannot be transmitted back to Earth in real time.

Gravity Experiment

An experiment to measure Venus' density at different locations will use the radio subsystem. The gravity measurements will be taken when the high-gain antenna is pointed toward Earth, instead of the surface of Venus, and is in a radio transmission mode.

When a spacecraft is close to a massive body such as Venus, it experiences changes in acceleration due to irregularities in the density of the planet. Those speed variations can be determined by measuring the speed of the spacecraft every few seconds with an Earth-based radio tracking system. The changes in speed are gravity measurements.

The differences in speed will be very small, but even a small speed-up would be apparent by measuring the doppler shift of the radio wave. It would indicate a planet area of greater density. If the spacecraft showed a small deceleration, it would indicate an area of lesser density. These readings would give scientists a better understanding of the planet's interior.

Since Venus rotates very slowly beneath the orbiting spacecraft, one orbit profile will be very similar to the one preceding it. If many sequential orbits are obtained, their gravity profiles can be added to the topographic map.

With the present mission geometry, high-resolution gravity data will not be obtained until well into the extended mission. Then the gravity data will be acquired for only 160 more days because the Sun will come between the spacecraft and Earth for a period of time.

This factor limits the global gravity coverage to 66 percent. However, there is a subsequent period of 265 days during which complete high-resolution global coverage can be obtained without interference caused by planetary positions.

MAGELLAN SCIENCE TEAM

The Magellan science team includes members representing five nations. Investigators were selected by NASA from institutions scattered throughout the United States: Aerospace Corporation, Geological Technology Research Institute, National Astronomy and Ionosphere Center of Cornell University (Puerto Rico), Rand Corp., Smithsonian Astrophysical Observatory and Vexcel Corp.

University participation is through the Massachusetts Institute of Technology; Brown, Southern Methodist, Stanford and Washington Universities; and the Universities of Arizona, Arkansas and California. Governmental agency participants are from NASA centers and the U.S. Geological Survey.

International investigators come from the Australian National University, the Canada Center for Remote Sensing, the Universities of London and Oxford and Ballard Laboratories (England), and the Group de Recherches de Geodesie Spatiale and the Observatoire de Pic-du-Midi-Toulouse (France).

VENUS FACTS

Radius: 3,630 miles
Rotational Period: 243 Earth days
Orbit Period: 225 Earth days
Distance from Sun: 64,920,000 miles
Density: 5.2 times that of water
Surface Gravity: .907 times that of Earth's gravity
Atmospheric Pressure at Surface: 90 times that of Earth's surface pressure
Temperature at Surface: 850 degrees Fahrenheit
Atmospheric Composition: Carbon dioxide (96%); nitrogen (3+%); trace amounts of sulfur dioxide, water vapor, carbon monoxide, argon, helium, neon, hydrogen chloride and hydrogen fluoride

MAGELLAN MISSION HIGHLIGHTS

Interplanetary Cruise: 442 - 468 days
Planned Trajectory Correction Maneuvers - 15 days after deployment from Shuttle; 360 days after deployment from Shuttle; and 17 days before Venus orbit insertion
Orbit Insertion: Aug. 10, 1990, 1700 GMT, STAR 48 solid rocket motor fires to put spacecraft in orbit around Venus
Mapping Orbit Period: 3.15 hours
Radar Mapping: 37 minutes per orbit
Mapping Orbit Inclination: 86 degrees
Superior Conjunction: Oct. 26 - Nov. 9, 1990
End of Nominal Mission: April 28, 1991
Data Gap Recoverable: June 27 - July 10, 1991

RADAR INVESTIGATION GROUP

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Merton E. Davies, Rand Corporation
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INERTIAL UPPER STAGE

The Inertial Upper Stage (IUS) will be used with the Space Shuttle to transport NASA's Magellan spacecraft out of Earth's orbit to Venus, some 26 million miles from Earth.

IUS-18, the IUS to be used on mission STS-30, is a two-stage solid-propellant vehicle weighing approximately 32,500 pounds.

The IUS is 17 feet long and 9.25 ft. in diameter. It consists of an aft skirt; an aft stage solid rocket motor (SRM) containing approximately 21,400 lb. of propellant and generating approximately 42,000 lb. of thrust; an interstage; a forward stage SRM with 6,000 lb. of propellant generating approximately 18,000 lb. of thrust; and an equipment support section.

The equipment support section contains the avionics, which provide guidance, navigation, control, telemetry, command and data management, reaction control and electrical power. All mission-critical components of the avionics system, along with thrust vector actuators, reaction control thrusters, motor igniter and pyrotechnic stage separation equipment are redundant to assure better than 98 percent reliability.

The IUS Airborne Support Equipment (ASE) is the mechanical, avionics, and structural equipment located in the orbiter. The ASE support the IUS and the Magellan in the orbiter payload bay and elevates the Magellan/IUS combination on a tilt table to 52 degrees for final checkout and deployment from the orbiter.

The IUS ASE consists of the structure, aft tilt-frame actuator, batteries, electronics and cabling to support the Magellan/IUS combination. These ASE subsystems enable the deployment of the combined vehicle; provide, distribute and/or control electrical power to the IUS and spacecraft; and serve as communication conduits between the IUS and/or spacecraft and the orbiter.

The IUS structure is capable of supporting all the loads generated internally and also by the cantilevered spacecraft during orbiter operations and IUS free flight. In addition, the structure physically supports all the equipment and solid rocket motors within the IUS, and provides the mechanisms for IUS stage separation. The major structural assemblies of the two-stage IUS are the equipment support section, interstage and aft skirt. It is made of aluminum skin-stringer construction, with longerons and ring frames.

The equipment support section houses the majority of the avionics of the IUS. The top of the equipment support section contains the spacecraft interface mounting ring and electrical interface connector segment for mating and integrating the spacecraft with the IUS. Thermal isolation is provided by a multilayer insulation blanket across the interface between the IUS and Magellan.

The avionics subsystems consist of the telemetry, tracking, and command subsystems; guidance and navigation subsystem; data management; thrust vector control; and electrical power subsystems. These subsystems include all the electronic and electrical hardware used to perform all computations, signal conditioning, data processing, and formatting associated with navigation, guidance, control, data and redundancy management. The IUS avionics subsystems also provide the equipment for communications between the orbiter and ground stations, as well as electrical power distribution.

Attitude control in response to guidance commands is provided by thrust vectoring during powered flight and by reaction control thrusters while coasting.

Attitude is compared with guidance commands to generate error signals. During solid motor firing, these commands gimble the IUS's movable nozzle to provide the desired attitude pitch and yaw control. The IUS's roll axis thrusters maintain roll control. While coasting, the error signals are processed in the computer to generate thruster commands to maintain the vehicle's attitude or to maneuver the vehicle.

The IUS electrical power subsystem consists of avionics batteries, IUS power distribution units, power transfer unit, utility batteries, pyrotechnic switching unit, IUS wiring harness and umbilical, and staging connectors. The IUS avionics system distributes electrical power to the Magellan/IUS interface connector for all mission phases from prelaunch to spacecraft separation.

The IUS two-stage vehicle uses both a large and small SRM. These motors employ movable nozzles for thrust vector control. The nozzles provide up to 4 degrees of steering on the large motor and 7 degrees on the small motor. The large motor is the longest thrusting duration SRM ever developed for space, with the capability to thrust as long as 150 seconds. Mission requirements and constraints (such as weight) can be met by tailoring the amount of propellant carried.

The reaction control system controls the Magellan/IUS spacecraft attitude during coasting; roll control during SRM thrustings; velocity impulses for accurate orbit injection; and the final collision avoidance maneuver.

As a minimum, the IUS includes one reaction control fuel tank with a capacity of 120 lb. of hydrazine. Production options are available to add a second or third tank; however, IUS-18 will require only one tank, with 120 lb. of fuel.

To avoid spacecraft contamination, the IUS has no forward facing thrusters. The reaction control system is also used to provide the velocities for spacing between several spacecraft deployments and avoiding collision or contamination after the spacecraft separates.

The Magellan spacecraft is physically attached to the IUS at eight attachment points, providing substantial load carrying capability while minimizing the transfer of heat across the connecting points. Power, command and data transmission between the two are provided by several IUS interface connectors. In addition, the IUS provides a multilayer insulation blanket of aluminized Kapton with polyester net spacers across the Magellan/IUS interface, along with an aluminized Beta cloth outer layer. All IUS thermal blankets are vented toward and into the IUS cavity, which in turn is vented to the orbiter payload bay. There is no gas flow between the spacecraft and the IUS. The thermal blankets are grounded to the IUS structure to prevent electrostatic charge buildup.

After the orbiter payload bay doors are opened in orbit, the orbiter will maintain a preselected attitude to keep the payload within thermal requirements and constraints.

On-orbit IUS predeployment checkout is accomplished, followed by an IUS command link check and spacecraft communications check. Orbiter trim maneuver(s) are normally performed at this time.

Forward payload restraints will be released and the aft frame of the airborne support equipment will tilt the Magellan/IUS to 29 degrees. This will extend the payload into space just outside the orbiter payload bay, allowing direct communication with Earth during systems checkout. The orbiter will then be maneuvered to the deployment attitude. If a problem has developed within the spacecraft or IUS, the IUS and its payload can be restowed.

Prior to deployment, the spacecraft electrical power source will be switched from orbiter power to IUS internal power by the orbiter flight crew. After verifying that the spacecraft is on IUS internal power and that all Magellan/IUS predeployment operations have been successfully completed, a "Go/No-Go" decision for deployment will be sent to the crew.

When the orbiter flight crew is given a "Go" decision, it will activate the ordnance that separates the spacecraft's umbilical cables. The crew will then command the electromechanical tilt actuator to raise the tilt table to a 52-degree deployment position. The orbiter's Reaction Control System (RCS) thrusters will be inhibited and an ordnance separation device initiated to physically separate the IUS/spacecraft combination from the tilt table. Compressed springs provide the force to jettison the IUS/Magellan from the orbiter payload bay at approximately 6 inches per second. The deployment is normally performed in the shadow of the orbiter or in Earth eclipse.

The tilt table will then be lowered to minus 6 degrees after the IUS and spacecraft are deployed. A small orbiter maneuver will be made to back away from IUS/Magellan. Approximately 19 minutes after deployment the orbiter's OMS engines will be ignited to move the orbiter away from the IUS/spacecraft.

After deployment, IUS/Magellan is controlled by the IUS onboard computers. Approximately 10 minutes after IUS/Magellan is deployed from the orbiter, the IUS onboard computer will send out signals used by the IUS and/or Magellan to begin mission sequence events. This signal also will enable the RCS and initiate deployment of the spacecraft's solar panels. All subsequent operations will be sequenced by the IUS computer, from transfer orbit injection through spacecraft separation and IUS deactivation.

After the RCS has been activated, the IUS will maneuver to the required thermal attitude and perform any required spacecraft thermal control maneuvers.

At approximately 45 minutes after deployment from the orbiter, the ordnance inhibits for the first SRM will be removed. The belly of the orbiter already will have been oriented towards the IUS/Magellan combination to protect the orbiter windows from the IUS's plume. The IUS will recompute the first ignition time and maneuvers necessary to attain the proper attitude for the first thrusting period. When the proper transfer orbit

opportunity is reached, the IUS computer will send the signal to ignite the first-stage motor. After firing approximately 150 seconds, the IUS first stage will have expended its fuel and will be separated from the IUS second stage.

Approximately 2.5 minutes after first-stage burnout, the second-stage motor will be ignited, thrusting about 108 seconds. The IUS second stage will then separate and perform a final collision/contamination avoidance maneuver before deactivating.

The IUS was developed and built by Boeing Aerospace, Seattle, under contract to the Air Force Systems Command's Space Systems Division. The Space Systems Division is executive agent for all Department of Defense activities pertaining to the Space Shuttle system and provides the IUS to NASA for Shuttle use.

MESOSCALE LIGHTNING EXPERIMENT

The Mesoscale Lightning Experiment (MLE) is designed to obtain nighttime images of lightning in an attempt to better understand what effects lightning discharges have on each other, on nearby storm systems, on storm microbursts and wind patterns, and other interrelationships over an extremely large geographical area. This information could lead to better Earth weather prediction models for use in airline operations and such applications as lightning early warning systems for outdoor crews of oil derricks, electrical power companies, large cranes and construction equipment.

In recent years, NASA has used high-altitude U-2 aircraft instrumented to conduct atmospheric and electricity research over the tops of active thunderstorms. The objectives of these flights have been to determine some of the baseline design requirements for a satellite-borne optical lightning mapper sensor, to study the overall optical and electrical characteristics of lightning as viewed from above cloudtops and to investigate the relationship between storm electrical development and the structure, dynamics and evolution of thunderstorms and thunderstorm systems.

Since scientists largely have satisfied the need to acquire a quantitative data base for design of a lightning mapper sensor, the lightning research goals now focus primarily on characterizing the types of optical and electrical signals it produces.

As such, many of the U-2 flights have been coordinated with large ground-based meteorological centers and satellites to gather data on lightning using doppler and conventional radar, ground-based and airborne electricity and microphysical observations, detailed precipitation measurements, ground strike lightning mapping, and visible and infrared Geosynchronous Operational Environmental Satellite images.

Electric field meters and conductivity probes have been added recently to the U-2 instrument package to measure electric fields and conductivity. This provides a means to estimate the current flowing from a thunderstorm to the ionosphere. But optically, the area photographed by an aircraft is limited by the maximum height it can fly. To document large or mesoscale areas, video must be obtained from satellites or the Space Shuttle.

The MLE will employ Shuttle payload bay cameras to observe lightning discharges at night from active storms. Using the Shuttle's payload bay color video camera augmented by a 35mm handheld still picture camera with 400 ASA film, the Shuttle cameras' 40-degree field of vision will cover an area rougly 200 by 150 nautical miles directly below the Shuttle.

Astronauts also will document mesoscale storm systems that are oblique to the Shuttle but near NASA ground-based lightning detection facilities at Marshall Space Flight Center, Huntsville, Ala., Kennedy Space Center, Fla. and the National Oceanic and Atmospheric Administration's Severe Storms Laboratory, Norman, Okla.

The Shuttle payload bay camera system will be stationary, pointed directly below the orbiter. The imagery will be analyzed for the frequency of flashes, the size of the lightning and its brightness.

Experiment investigators will analyze the lightning data taken from the Shuttle as well as information from the ground-based lightning detection network. Otha H. Vaughan, Jr., is principal investigator. Co-investigators are Dr. Bernard Vonnegut, State University of New York, Albany; Dr. Marx Brook, New Mexico Institute of Mining and Technology, Socorro; and Dr. Richard Blakeslee, Marshall Space Flight Center. Gregory Wilson is the Marshall mission manager.

MICROGRAVITY RESEARCH WITH THE FLUIDS EXPERIMENT APPARATUS

Rockwell International, through its Space Transportation Systems Division, Downey, Calif., is engaged in a joint endeavor agreement (JEA) with NASA's Office of Commercial Programs in the field for floating zone crystal growth research. The agreement, signed on March 17, 1987, provides for microgravity experiments to be performed in the company's microgravity laboratory, the Fluids Experiment Apparatus (FEA), on two Space shuttle missions.

Under the sponsorship of the NASA Office of Commercial Programs, the FEA will fly aboard Atlantis on STS-30. Rockwell's Space Transportation Systems Division is responsibe for developing the FEA hardware and for integrating the experiment payload. Rockwell's Science Center in Thousand Oaks, Calif., has the responsibility for developing the materials science experiments and for analyzing their results.

The Indium Corporation of America of Utica, New York is collaborating with the Science Center in the development and analysis of the experiments and is providing the three Indium samples to be processed on the FEA-2 Mission. NASA will provide standard Space Shuttle flight services under the JEA.

Floating Zone Crystal Growth and Purification

The floating zone process involves an annular heater that melts a length of sample material and them moves along the sample. As the heater moves (translates), more and more of the polycrystalline material in front of it melts. The molten material behind the heater will cool and resolidify.

The presence of a "seed" crystal at the initial solidification interface, will establish the crytallographic lattice structure and orientation of the single crystal that results. Impurities in the polycrystalline material will tend to stay in the melt as it passes along the sample and will be deposited at the end when the heater is turned off and the melt finally solidifies.

On the ground, under the influence of gravity, the length of the melt is dependent upon the density and surface tension of the material being processed. Many industrially important materials cannot be successfully processed because of their properties. In the microgravity environment of spaceflight, the length of the melt is only limited to the diameter of the sample and is independent of material properties.

Materials of industrial interest include indium antimonide, cadmium telluride, gallium arsenide and others. Potential applications for these materials include advanced electronic, electo-optical and optical devices and high-purity feed stock.

The FEA-2 experiments involve five samples, three of indium with a melting point of 156 Celsius and two of selenium with a melting point of 217 Celsius. Each sample will be 1 centimeter in diameter by 19 centimeters long. The heater translation rates and process durations are given by the table on the next page.

Sample	Material	Heater Rate (centimeters/hours)	Duration (hours)
1	indium	0	2
2	indium	0	2
3	indium	1.25	16
4	selenium	1.25	16
5	selenium	0.62	16

On orbit, the flight crew will prepare the FEA by connecting its computer and camera. The five experiment samples will be sequentially installed in the FEA at mission elapsed times of 21.5, 25.9, 30.1, 51.9 and 73.5 hours, respectively, and processed according to their unique requirements. The experiment parameters (heater power and translation rate) will be controlled by the operator through the FEA control panel.

Sample behavior, primarily melt zone length, will be observed by the operator and recorded by the FEA camera. Experiment data (heater power, heater translation rate, heater position, experiment time, and various experiment and FEA temperatures) will be formatted, displayed to the operator and recorded by the computer. The operator will record mission elapsed time at the start of each experiment as well as significant orbiter maneuvers during FEA operations.

In general, the experiment process involves installing a sample in the FEA, positioning the heater at a predesignated point along the sample, turning on the heater to melt a length of sample (approximately twice the diameter), starting the heater translation at a fixed rate (for the last three samples only), and maintaining a constant the melt zone length by controlling the heater power.

Once the end of the sample is reached, the heater is turned off and the translation reversed until it reaches the starting end of the sample. The sample, camera film and computer disk then can be changed and the next experiment started.

Fluids Experiment Apparatus (FEA)

The FEA is designed to perform materials processing research in the microgravity environment of spaceflight. Its design and operational characteristics are based on actual industrial requirements and have been coordinated thoroughly with industrial scientists and NASA materials-processing specialists and Space Shuttle operations personnel. Convenient, low-cost access to space for basic and applied research in a variety of product and process technologies is provided by the FEA.

The FEA is a modular microgravity chemistry and physics laboratory for use on the Space Shuttle and supports materials processing research in crystal growth, general liquid chemistry, fluid physics and thermodynamics. It has the functional capability to heat, cool, mix, stir or centrifuge experiment samples that can be gaseous, liquid or solid. Samples can be processed in a variety of containers or in a semicontainerless floating zone mode. Multiple samples can be installed, removed or exchanged during a mission through a 14.1 by 10 inch door in the FEA's cover.

Instrumentation can measure sample temperature, pressure, viscosity, etc. A video or super-8 millimeter movie camera can be used to record sample behavior. Experiment data can be displayed and recorded through the use of a portable computer that also is capable of controlling experiments.

Interior dimensions of the FEA are approximately 18.6 by 14.5 by 7.4 inches, and it can accommodate approximately 26 pounds of experiment-unique hardware and subsystems. It mounts in place of a standard stowage locker in the middeck of the Shuttle crew compartment, where it is operated by the flight crew. This installation and means of operation permit the FEA to be flown on most Space Shuttle missions.

Modular design permits the FEA to be easily configured for almost any experiment. Configurations even can be changed in orbit, permitting experiments of different types to be performed on a given Shuttle mission. Optional subsystems can include custom furnace and oven designs, special sample containers, low-temperature air heaters, specimen centrifuge, special instrumentation, and other systems specified by the user. Up to 100 watts of 120 volt, 400-hertz power is available from the Shuttle orbiter for FEA experiments.

AIR FORCE MAUI OPTICAL SITE CALIBRATION TEST

The Air Force Maui Optical Site (AMOS) tests allow ground-based electro-optical sensors located on Mt. Haleakala, Maui, Hawaii, to collect imagery and signature data of the orbiter during cooperative overflights. The scientific observations made of the orbiter, while performing reaction control system thruster firings, water dumps or payload bay light activation, are used to support calibration of the AMOS sensors and the validation of spacecraft contamination models. The AMOS tests have no payload-unique flight hardware and only require that the orbiter be in predefined attitude operations and lighting conditions.

The AMOS facility was developed by the Air Force Systems Command (AFSC) through its Rome Air Development Center, Griffiss Air Force Base, N.Y., and is administered and operated by the AVCO Everett Research Laboratory in Maui. The principal investigator for the AMOS tests on the Space Shuttle is from AFSC's Air Force Geophysics Laboratory, Hanscom Air Force Base, Mass. A co-principal investigator is from AVCO.

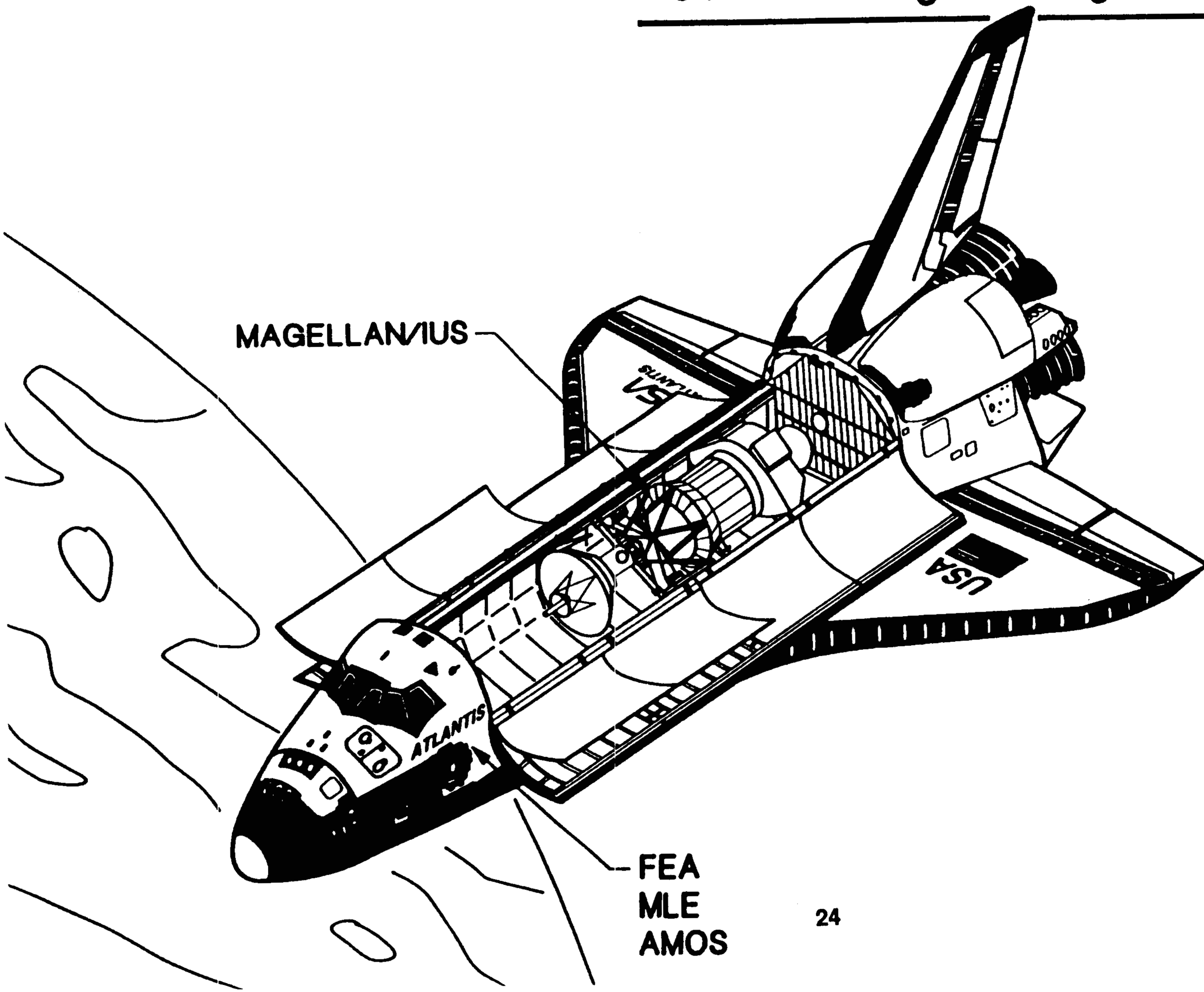
Flight planning and mission support activities for the AMOS test opportunities are provided by a detachment of AFSC's Space Systems Division at Johnson Space Center. Flight operations are conducted at JSC Mission Control Center in coordination with the AMOS facilities located in Hawaii.

PAYLOAD AND VEHICLE WEIGHTS

Vehicle/Payload	Weight (Pounds)
Orbiter Atlantis (Empty)	171,600
Magellan/IUS	45,748
DSO	6
FEA	128
IUS Support Equipment	204
MLE	31
Orbiter and Cargo at SRB Ignition	217,513
Total Vehicle at SRB Ignition	4,525,116
Orbiter Landing Weight	192,313

NASA
C807359C.ART;1

National STS Program
STS-30 Cargo Configuration



SPACEFLIGHT TRACKING AND DATA NETWORK

Primary communications for most activities on STS-30 will be conducted through the Tracking and Data Relay Satellite System (TDRSS). However, the NASA Spaceflight Tracking and Data Relay Network of ground stations will continue to play a role in the mission. The stations, along with the NASA Communications Network, at Goddard Space Flight Center in Greenbelt, Md., will serve as backups for communications with Space Shuttle Atlantis should a problem develop in the satellite communications.

Ground tracking facilities serve as focal points during the launch and ascent of the Shuttle from Kennedy Space Center, Fla. For the first minute and 20 seconds, all voice, telemetry and other communications from the Shuttle are relayed to the mission managers at Kennedy and at Johnson Space Center, Houston, by the Merritt Island facility.

At 1 minute, 20 seconds, the communications are picked up from the Shuttle and relayed to KSC and JSC from the Ponce de Leon facility, 30 miles north of the launch pad. This facility provides the communications for 70 seconds during a critical period when exhaust energy from the solid rocket motors "blocks out" the Merritt Island antennas.

The Merritt Island facility resumes communications to and from the Shuttle after those 70 seconds and maintains them until 6 minutes, 30 seconds after launch when communications are "switched over" to Bermuda. Bermuda then provides the communications until 11 minutes after liftoff. At that time, TDRS-East acquires the satellite.

With the completion of the TDRS constellation of three satellites on mission STS-29 in March, plans are underway to phase out five of the ground stations. They are Guam, after June 30, 1989; Ascension Island, Hawaii and Santiago, Chile, after Sept. 30, 1989; and Dakar, Senegal, on Dec. 30, 1990. After these stations are closed, the Merritt Island, Ponce de Leon, Bermuda and Wallops Island, Va., stations will remain in operation.

CREW BIOGRAPHIES

DAVID M. WALKER, 44, captain, USN, is mission commander. Although born in Columbus, Ga., he considers Eustis, Fla., his hometown. Walker is a member of the astronaut class of 1978.

Walker was pilot of STS-51A, launched Nov. 8, 1984, marking the second flight of the orbiter Discovery. During the mission, the crew deployed two satellites and, in the first space salvage mission in history, also retrieved and returned to Earth the Palapa B-2 and Westar VI satellites.

His assignments also have included: Astronaut Office safety officer; deputy chief of Aircraft Operations; STS-1 chase pilot; software verification at the Shuttle Avionics Integration Laboratory (SAIL); and assistant to the director, Flight Crew Operations. He has logged 192 hours in space.

Walker earned a B.S. degree from the U.S. Naval Academy in 1966. He received flight training from the Naval Aviation Training Command at bases in Florida, Mississippi and Texas. He completed two combat cruises in Southeast Asia as a fighter pilot, flying F-4 Phantoms aboard the carriers USS Enterprise and USS America.

In January 1972, Walker became an experimental and engineering test pilot in the flight test division at the Naval Air Test Center, Patuxent River, Md. Walker has logged more than 5,000 hours flying time, 4,500 in jet aircraft.

RONALD J. GRABE, 43, colonel, USAF, is pilot. He was born in New York, N.Y., and is a member of the astronaut class of 1981. Grabe was pilot for STS-51J, the second Space Shuttle Department of Defense mission, launched Oct. 3, 1985, on the orbiter Atlantis' maiden voyage. He has logged 98 hours in space.

Grabe earned a B.S. degree in engineering science from the U.S. Air Force Academy in 1966 and studied aeronautics as a Fulbright Scholar at the Technische Hochschule, Darmstadt, West Germany, in 1967.

Following his studies in West Germany, Grabe returned to the United States to complete pilot training at Randolph Air Force Base, Texas. In 1969, he was assigned as an F-100 pilot with the 3rd Tactical Fighter Wing at Bien Hoa Air Base, Republic of Vietnam, where he flew 200 combat missions.

Grabe graduated from the USAF Test Pilot School in 1975 and was assigned to the Air Force Flight Test Center as a test pilot for the A-7 and F-111. He later served as an exchange test pilot with the Royal Air Force at Boscombe Down, United Kingdom, from 1976 at Edwards Air Force Base, Calif., when advised of his selection by NASA. Grabe has logged more than 4,000 hours flying time.

NORMAN E. THAGARD, M.D., 45, is mission specialist 1 (MS-1). Although born in Marianna, Fla., Thagard considers Jacksonville, Fla., his hometown. He is a member of the astronaut class of 1978.

Thagard was a mission specialist on STS-7, launched June 8, 1983. It was the second flight for the orbiter Challenger and the first mission with a five-person crew. During the mission, the STS-7 crew operated the Canadian-built remote manipulator system arm to perform the first deployment and retrieval exercise with the Shuttle Pallet Satellite (SPAS-01); conducted the first formation flying of the orbiter with a free-flying satellite (SPAS-01); and carried and operated the first U.S./German cooperative materials science payload. During the flight, Thagard conducted various medical tests and collected data on physiological changes associated with astronaut adaptation to space.

Thagard also served as a mission specialist on STS-51B, the Spacelab-3 science mission, launched April 29, 1985, aboard Challenger. Duties on orbit included satellite deployment operation with the NUSAT satellite and care for the 24 rodents and two squirrel monkeys contained in the Research Animal Holding Facility.

Thagard earned B.S. and M.S. degrees in engineering science from Florida State Univeristy before earning an M.D. degree from the University of Texas Southwestern Medical School in 1977.

After entering active duty with the U.S. Marine Corps Reserve, Thagard achieved the rank of captain in 1967 and a year later was designated a naval aviator assigned to fly F-4s at Marine Corps Air Station, Beaufort, S.C. He flew 163 combat missions in Vietnam in 1969 and 1970. Thagard resumed his academic studies in 1971, pursuing additional studies in electrical engineering and a degree in medicine.

Thagard is a pilot and has logged over 2,200 hours flying time, the majority in jet aircraft.

MARY L. CLEAVE, Ph.D., 42, is mission specialist 2 (MS-2). Cleave was born in Southampton, N.Y. She is a member of the astronaut class of 1980.

Cleave was a mission specialist on STS-61B which was launched at night, Nov. 26, 1985. During the mission, the crew deployed communications satellites and conducted two 6-hour spacewalks to demonstrate Space Station construction techniques with the EASE/ACCESS experiments. This was the heaviest payload weight a Space Shuttle had carried to orbit. Cleave also has worked as a capsule communicator (capcom) in the Mission Control Center on five Space Shuttle flights. Cleave has logged 165 hours in space.

Cleave earned a B.S. degree in biological sciences from Colorado State University in 1969. She earned an M.S. degree in microbial ecology and a Ph.D. in civil and environmental engineering from Utah State University in 1975 and 1979, respectively.

Cleave held graduate research, research phycologist and research engineer assignments in the Ecology Center and the Utah Water Research Laboratory at Utah State University from 1971 to 1980.

MARK C. LEE, 36, major, USAF, is mission specialist 3 (MS-3). This will be his first space flight. Born in Viroqua, Wis., he is a member of the astronaut class of 1984.

Lee has participated in the planning and simulation of several extravehicular activity missions and has served as the support crewmember for mission STS-51I, Leasat retrieval and repair. He also has served as a capcom.

Lee earned a B.S. degree in civil engineering from the U.S. Air Force Academy in 1974 and a M.S. degree in mechanical engineering from Massachusetts Institute of Technology in 1980.

Following pilot training at Laughlin Air Force Base, Texas, Lee spent 2 1/2 years at Okinawa Air Base, Japan, in the 25th Tactical Fighter Squadron flying F-4s. In 1982, he served as the 388TFW deputy commander for operations, executive officer and flight commander in the 4th Tactical Fighter Squadron at Hill Air Force Base, Utah, until his selection as an astronaut candidate. Lee has logged 2,000 hours flying time, primarily in the T-38, F-4 and F-16 aircraft.

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